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**NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT, INC.**

Tom Danielson  
Bureau of Land and Water Quality  
Department of Environmental Protection  
17 State House Station  
Augusta, ME 04333-0017

July 31, 2009

Dear Mr. Danielson,

The National Council for Air and Stream Improvement (NCASI) is a non-profit membership funded organization created in 1943 whose mission is to address, through its research program, the environmental information needs of the forest products industry. NCASI's member companies collectively produce over 95% of the pulp and paper and a sizeable fraction of the wood products manufactured in the United States. Since its formation, the management of water resources important to the forest product industry has been a cornerstone of NCASI's research program. For this reason, NCASI was asked by some of its member companies to review the recently proposed regulations for the state of Maine, Chapter 583, "Nutrient Criteria for Fresh Surface Waters." We have conducted a review of this and other associated documents made available at

[http://www.state.me.us/dep/blwq/rules/Other/nutrients\\_freshwater/index.htm](http://www.state.me.us/dep/blwq/rules/Other/nutrients_freshwater/index.htm) ) by Maine Department of Environmental Protection (MDEP). Particular attention was given to the "Description of Nutrient Criteria for Fresh Surface Waters (Chapter 583)" ("Description document") which contains information on the technical basis for the criteria. We respectfully offer the following comments for consideration as MDEP works on the challenging task of developing numeric nutrient criteria for Maine.

Rule Summary

The proposed rule includes criteria for total phosphorus, the lone causal variable (as defined in EPA numeric nutrient criteria development guidance such as EPA 2000), and eight environmental response criteria. A "decision framework" is also contained in the proposed rule that describes how various findings for each criteria will be used to decide whether or not a water body is impaired, i.e. does not meet water quality standards, and whether the cause of the impairment is phosphorus, another nutrient (e.g. nitrogen), or a different stressor altogether. An important element of the decision framework is a component that states a water body will not be considered impaired when the total phosphorus criterion is exceeded but all required environmental response measurements are within specified limits.

Nutrient criteria are established for five statutory water body classes (Maine's Water Classification System), Class AA, A, B, C, and GPA (lakes/ponds). Class AA, A, B, and C apply to streams, rivers,

and wetlands with or without impoundments. These four classes represent a system of tiered aquatic life use, with Class AA being the most protective (i.e., “as naturally occurs”), and Classes A, B, and C allowing increased levels of permitted activities such as dams and point source discharges. All classes support indigenous fish populations and aquatic life community structure and function, and are considered unimpaired with respect to water quality standards.

The proposed total phosphorus criteria (Table 1), in ug/L or parts per billion (ppb), are:

- AA and A:  $\leq 20.0$
- B:  $\leq 32.0$
- C:  $\leq 37.0$
- GPA:  $\leq 15.0$

In addition, the proposed rule lists the environmental response variables applicable to each water body type (Table 2) and the associated criteria that are to be met for each class (Table 3).

Comment #1: The decision framework is a strength of the proposed rule. However, the role of the phosphorus “limits” and the acceptability of this approach to EPA are unclear.

The decision framework provides appropriate recognition that the influence of nutrients such as phosphorus and nitrogen in aquatic ecosystems and their designated uses may depend upon a number of other environmental factors, and consequently, information on the biological and/or ecological condition of the water body is important to proper identification and management of nutrient concerns. The decision framework is structured to identify situations in which phosphorus has caused or contributed to a designated use impairment. Those situations are represented in Box 4 of the framework, where the “mean total phosphorous concentration” exceeds the value in Table 1 for a given water body type, and one or more of the appropriate response variables (given in Table 2) do not meet the environmental response criteria provided in Table 3. Box 2 represents a case in which the phosphorous criterion is exceeded but all of the appropriate response criteria are met. The resulting decision would be, appropriately, that the water body is not impaired and the phosphorus concentration alone does not reflect an impaired use.

However, it is not clear that this approach is consistent with EPA guidance (e.g. EPA 2000), and that an exceedance of the numeric phosphorous criterion will not independently indicate use impairment. Furthermore, current rule language is confusing with regard to how the proposed phosphorus concentration values may ultimately be used. For example, the purpose and applicability of the proposed rule as specified in Section 2 states:

“The purpose of this Chapter is to describe *environmental response criteria* (emphasis added) used to determine impairment of a designated or existing use as described in 38 M.R.S.A. §§ 464(4), 465, and 465-A due to phosphorus or another nutrient.”

This indicates that the focus of the rule is on the process the state will use to determine use impairment based on environmental responses that may result from excess phosphorus, nitrogen, or possibly some other nutrient, which are referred to as “causal” variables in EPA guidance (e.g., EPA 2000). Then, in the section titled “Nutrient Indicators and Decision Framework”, the description document states:

“The proposed decision framework does not create new criteria for phosphorus or nitrogen. It does include some new numeric guidelines to interpret attainment of designated uses and narrative criteria.”

These sentences seem to clearly state that no new numeric criteria for phosphorus or nitrogen are being proposed but that the values are intended only to be “guidelines” used in the decision framework. The term “limits” is commonly used in the proposed rule to refer to the phosphorus concentration values. However, the summary statement provided at the beginning of the proposed rule states:

“This Chapter establishes nutrient criteria for Class AA, A, B, C, and GPA surface waters of the State.”

Here the proposed rule does not distinguish between causal and response variables, suggesting that the proposed phosphorus concentration values are nutrient “criteria” in the way EPA guidance describes. In this case, exceedances of these phosphorus concentrations may be interpreted independently as nonattainment of water quality standards rather than as part of the proposed decision framework. MDEP should clarify the intended use of the total phosphorus concentrations as guidance values only, and the acceptability of this approach with EPA.

Comment #2: Aspects of the data supporting the decision framework should be clarified.

Section 3, “Nutrient criteria and decision framework”, is divided into three main subsections, titled “Total phosphorous concentrations”, “Environmental response criteria”, and “Nutrient decision framework outcomes (Figure 1)”. The first subsection, “Total phosphorous concentrations”, simply states the following:

“The limits for total phosphorus, measured as the mean of an established set of samples, are set forth in Table 1 for each statutory class.”

It is not clear what is meant by “an established set of samples”. At a minimum, adding a reference here would help to clarify the intended definition. This reference might simply be to some other more detailed sampling/data collection protocol.

Important information is lacking for several of the variables on how the values used in the decision framework will be generated, including the number and timing of samples, analytical protocols, and statistical procedures or other numerical methods that should be used.

Comment #3: Few details are provided in this rule regarding the use of criteria to ensure the protection of downstream waters as called for by EPA.

The description associated with Box 2 of the decision framework states that where a phosphorus limit is exceeded but response criteria are met:

“The Department subsequently may examine downstream waterbodies to determine if there are any adverse effects downstream.”

This statement suggests that the total phosphorus criterion developed to protect the immediate receiving water would be the trigger for examining whether phosphorus is affecting downstream water bodies. Because the ecological processes affecting the immediate receiving water and downstream receiving waters may be very different, this would seem to be an inaccurate way to

approach the protection of downstream waters. Likewise, EPA is unlikely to agree that the conditions represented in Box 1, in which all criteria are met in the receiving water, or in the impaired cases (Box 3 and Box 4), ensure the protection of downstream waters. The proposed framework includes no consideration of nutrient impacts on downstream water bodies for any of these alternative cases. Ensuring the protection of downstream waters from nutrient impacts from all sources in a watershed is a complex task that this draft rule does not yet adequately address. EPA is currently working with the Florida Department of Environmental Protection (FDEP) to explore the use of the USGS SPARROW model as a quantitative tool to develop criteria protective of downstream waters. Whether this or some other approach is sufficiently robust is as yet undetermined, but the discussion is an example of activity being carried out elsewhere to address the downstream waters topic quantitatively.

Comment #4: Several aspects of the derivation of total phosphorus criteria values require additional clarification.

The Description document indicates that a number of factors were considered in the derivation of the total phosphorous criteria presented for each water body class. For class GPA, factors include prior use of 15 ppb total phosphorus as a threshold for the prevention of nuisance algae blooms, and results of a statistical "change point" analysis. On page 11 of the Description document the relationship between chlorophyll a and secchi depth for lakes is discussed without a clear description of the data used in the analysis. Is it from probability-based sampling or other means of ensuring that all state waters are represented in a statistically rigorous way? The document should provide this information to allow others to more easily assess the appropriateness of the data.

For Class A streams and rivers, the 90<sup>th</sup> percentile value of total phosphorus concentrations from 126 reference streams is the basis of the total phosphorus criteria. MDEP chose the 90th percentile as opposed to EPA's recommended 75th percentile in part to limit the number of reference water bodies above the criteria concentration. Apparently, the derivation of Class A waters also includes/applies to Class AA waters: the total phosphorus criterion is the same (20 ppb) according to Table 1 of the draft rule, but the derivation for Class AA waters is not specifically mentioned in the Description document.

For Classes B and C, the total phosphorus criteria are based on the 75th percentile of concentrations from streams and rivers known to attain the aquatic life criteria for these water bodies. Here the MDEP justifies selecting the 75th percentile in order to extend additional protectiveness beyond the macroinvertebrate metrics primarily used to judge the attainment of the aquatic life use. This is based in part on a conclusion from linear regression analysis that pollution sensitive algae respond negatively more quickly than macro invertebrates to increasing total phosphorus concentrations. It's not clear why the same logic is not applied to the Class AA and/or Class A waters, in which case a 75th percentile value (rather than the 90th percentile) may ultimately be used. The Class B and Class C 75th percentiles are 32 ppb and 52 ppb, respectively.

However, the total phosphorus criterion for Class C waters is further revised downward to 37 ppb based on results of a Conditional Probability Analysis (CPA) conducted to assess the probability of exceeding 40% algae cover. MDEP selected this value as a threshold to protect recreational uses based on EPA guidance and literature values because fewer data were available than for Class B streams. The total phosphorus concentration of 37 ppb is based on a decision by MDEP to limit the probability of exceeding 40% algae cover to no more than 40% (i.e., a 40% chance of exceeding 40% algae cover). Based on Figure 20 in the "Description document", had MDEP selected a 50% probability, the associated total phosphorus concentration would be closer to 50 ppb. It is not clear why MDEP selected a 40% probability, but this relatively low proportion would seem to

significantly increase the potential for declaring an unimpaired stream “impaired”. Although the decision framework seeks to minimize false impairment declarations through the use of information on biological response variables, it is not clear that such an approach will preclude the use of total phosphorus “limits” as independent criteria that must be attained, as previously discussed.

It is also important to interpret the 95% confidence interval in addition to the mean conditional probability estimate. The 95% confidence interval at total phosphorus = 37 ppb is roughly 15% to 55% (Figure 20 of the Description document). This is the uncertainty in the estimate of the conditional probability - the mean is 40 % but the probability of algal cover exceeding 40% could be as low as 15% and as high as 55% (at 95% confidence).

The peer-reviewed article by Paul and McDonald (2005) regarding the use of CPA for the derivation of water quality criteria identifies five conditions that are important to the use of CPA. One of these is that monitored data have been collected from a probability based sampling design. If this is not the case, then the data used in CPA may not adequately represent the population of expected values of the causal and response variables, and the output of the CPA will be inaccurate. The Description document does not provide enough information to allow a judgment regarding the adequacy of the available data and the potential for the output to be biased. How much total phosphorus data are available for Class B and C streams? From what months, for how long, and what is the frequency? Is the natural variability in total phosphorus concentration well captured? If not, the establishment of criteria at this point may lead to a number of false impairment determinations in the future as a more complete understanding of typical values is developed.

It is important to note that the EPA Science Advisory Board has recently initiated a process of reviewing new draft EPA technical guidance on the use of statistical approaches in the development of numeric nutrient criteria. Following this review, the guidance document may provide a critical new framework for the use of CPA and other statistical methods in establishing criteria that may support their consistent, reliable and robust use by states like Maine that are seeking to develop numeric nutrient criteria.

**Comment #5: The proposed chlorophyll a criterion of 8 ppb may be overly conservative and its application to all state waters does not appear to be well-supported.**

In general, the use of chlorophyll a concentration as a metric for making decisions about nutrients as a potential cause of water quality impairments is appropriate, at least for lakes and other deeper waters. However, establishing a criterion of 8 ppb, especially applied as a “not to exceed” value for single samples collected by techniques that are not well defined, may substantially increase the potential for ineffectual use impairment determinations. Information in Wetzel (1983) shows that annual mean chlorophyll a values for mesotrophic lakes and reservoirs have been found to exceed 8 ug/L, indicating that individual measurements greater than 8 ug/L may not reflect nutrient-related impaired uses. Chlorophyll a peaks above 10 ug/L have also been found in lakes considered by experts to be oligotrophic (Wetzel 1983). Based on the data shown in Figure 3 of the Description document, a relatively large proportion of the clear and colored lakes evaluated by MDEP will not meet the 8 ppb chlorophyll a criterion if adopted.

Further, it does not seem appropriate to apply the chlorophyll a:secchi depth relationship derived from lake data to shallow, wadable streams and rivers where similar secchi depth measurements cannot be made and where the aquatic ecosystem is very different. Also, it is not necessarily the case that the relationship between chlorophyll a and secchi depth will be the same for deeper rivers and impoundments as it is for lakes, or that a single changepoint would reflect the range of relationships

that may be present. The suspended solids characteristic of rivers and streams could differ sufficiently from lakes to affect the chlorophyll a criterion (or criteria) appropriate for these water body types.

Regarding the statistical analysis of the lake chlorophyll a and secchi depth data, no details are given explaining reasons for the removal (i.e., trimming) of 5 outliers prior to the change point analysis. The removal of outliers may or may not affect the outcome of the analysis; however, the exclusion of unusual values should be approached with caution, and the basis for their removal should be clearly described. Also, the approximate  $X^2$  test provides an indication of the statistical significance of the changepoint, but does not necessarily describe the “ecological significance” of the changepoint as the Description document states. Qian et al. (2003) state “... the deviance reduction approach will always find a changepoint no matter whether there is a real ecological change or not. Thus, we use the approximate  $X^2$  test to judge whether the resulting changepoint is *statistically* (emphasis added) significant.” It must also be kept in mind that while a statistically significant changepoint may indicate a real change in the relationship between two variables, it does not necessarily mean that the change is of significance to the structure or functions of the ecosystem. Neither does it necessarily coincide with a threshold of designated use impairment, which should be the emphasis of criteria development.

As with the use of CPA discussed previously, changepoint determination using nonparametric deviance reduction is likely to be considered in the new EPA draft statistical guidance referenced above and by the SAB committee that will be reviewing that guidance. Publication of the final guidance document may have implications for the use of this statistical procedure as a means to identify changepoints in chlorophyll a:secchi depth or other relationships.

Comment #6: Using a reference waterbody percentile approach may result in overly conservative criteria values.

Developing numeric nutrient criteria using a reference percentile approach (rather than the effects-based, or dose-response, alternative approach also described in EPA guidance), whether the 75<sup>th</sup> or the 90<sup>th</sup> percentile is selected, may underestimate the assimilative capacity of a water body relative to one or more designated uses. The percentile reflects only the distribution of available data, and therefore when the data are from reference waters the criteria may be significantly below total phosphorus concentrations that would support the designated uses of the water body. This problem may be further compounded if data do not adequately represent the range of phosphorus concentrations present. In the case of Class B or C waters in Maine, the Description document indicates that “most of the streams were represented by single nutrient samples.” This would seem to represent a considerable shortcoming of the basis for the total phosphorus values being proposed. Such limited data would suggest that the degree of variation in nutrient concentrations that may occur at different times at a single location is not well defined. This could have a significant effect on whether the criterion truly reflects the 90<sup>th</sup> percentile. If it reflects a lower percentile, future sampling would be expected to yield a number of unanticipated criterion “exceedances”. It is notable that the total phosphorus criteria currently being proposed in Wisconsin using an effects-based approach are 75 ppb for wadable streams and 100 ppb for nonwadable streams. These criteria are generally applicable state-wide, including the forested region in the northern third of the state which is part of the same Level III nutrient ecoregion, Nutrient Poor Largely Glaciated Upper Midwest and Northeast (Ecoregion VIII) that is dominant in Maine.

Comment #7: More detailed information on data requirements is appropriate to minimize the potential for impairment decisions to be made based on inaccurate or inadequate information.

The section titled "Data requirements" is divided into four subsections titled "'Responsibility for sampling", "Routine sampling", "Special circumstances", and "Data quality". The primary responsibility for the collection of data used to support use attainment decisions rests with MDEP, though other sources of data may be used and the Department may require monitoring in certain cases. The time period for "routine sampling" is generally from June 1 to September 30 for streams and May 1 through October 31 for lakes. The samples are not to be taken "during or soon after storms or flood events." Sampling may be conducted in "special circumstances" (i.e., non-routine sampling) when determined to be appropriate by MDEP. Only three general statements are provided regarding data quality, and no specific procedures are referenced or provided.

The note at the bottom of page 5 which states "All data collection will follow Department standard operating protocols and quality assurance procedures." does not provide specific enough information to ensure that the potential for false "impairment" determinations based on insufficient or inappropriate data or analyses will be minimized. As an example, the secchi disk response is to be measured for lakes and impounded Class A, B, or C waters. "All samples taken during the open water season" includes samples that are high in suspended solids due to run off and storm events. Section 4, "Data requirements", specifies that "Routine samples will not be taken during or soon after storms or flood events." However, nothing in the draft rule would seem to restrict the secchi disk measurements to "routine samples." Consequently, the lake or reservoir might be declared "impaired" due to phosphorus pollution with only a slightly elevated mean phosphorous concentration and a single short-term low secchi disk measurement resulting not from algal growth but rather from run off of suspended solids.

Comment #8: Several important nutrient-related questions are not addressed in this rule.

A number of numeric nutrient criteria/implementation questions remain. For example:

How would the new criteria be implemented in point source discharge license limitations? Details on topics such as appropriate averaging periods and effluent and receiving water design flows are important to the potential ecological relevance of the actions taken to ensure that nutrient-related water quality standards are met.

How will situations be addressed in which permit limits already exist based on a TMDL? Will new numeric criteria be established requiring different permit limitations for nutrients or will the TMDL-based limits remain in effect?

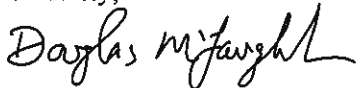
How would site-specific alternative criteria be developed for waters that do not meet the new numeric criteria but are not impaired from a biological/ecological perspective? This question is particularly relevant for those waters in each class that exceed the total phosphorus criteria percentiles selected by MDEP and one or more environmental response criteria (assuming EPA approves the draft decision framework).

How would nutrient impacts and possible criteria for downstream waters be established and implemented in discharge permits? Providing a more detailed approach in this rule is important in order to understand the full impact of numeric nutrient criteria.

In conclusion, the comments contained in this letter are offered in the interest of supporting appropriate, efficient management of nutrients in the surface waters of Maine, an interest no doubt

shared by MDEP and others. NCASI hopes they are useful as MDEP works to address the challenges associated with numeric nutrient criteria development. Please feel free to contact me with any questions you may have.

| Sincerely,

A handwritten signature in black ink, appearing to read "Douglas McLaughlin". The signature is fluid and cursive, with the first name "Douglas" being more prominent and the last name "McLaughlin" written in a more compact, flowing style.

Douglas McLaughlin, Ph.D.  
Principal Research Scientist

#### References

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Wetzel, R.G. 1983. *Limnology*. 2<sup>nd</sup> Edition, CBS College Publishing.